

Application No. 10/711,364
Technology Center 1775
Amendment dated June 6, 2007
Submission Accompanying RCE under 37 CFR §1.114

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Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

Claim 1 (Currently amended): A thermal barrier coating on a surface of a substrate, the thermal barrier coating being formed of at least one ceramic material and having a columnar microstructure comprising columns extending from the surface of the substrate, the columns having inner regions contacting the surface of the substrate, outer regions near an outermost surface of the thermal barrier coating, and interior regions therebetween, the inner regions of the columns being substantially normal to the surface of the substrate and the interior regions of the columns comprising multiple first portions ~~substantially normal to the surface of the substrate~~ and multiple second portions between the first portions so that each adjacent pair of the first portions is separated by one of the second portions, at least one of the first and second portions being linear, at least one adjacent pair of the first and second portions being separated and adjoined by a curved portion ~~separated~~

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~~by the first portions and not normal to the surface of the substrate so that the columns of the columnar microstructure are continuous but modulated within the interior regions. regions to reduce tensile stresses within the columns resulting from particle impact such that cracking of the columns from particle impact is more likely to occur within the outer regions of the columns as compared to the inner regions of the columns.~~

Claim 2 (Original): A thermal barrier coating according to claim 1, wherein the thermal barrier coating is characterized by the substantial absence of columns that are discontinuous between the surface of the substrate and the outermost surface of the thermal barrier coating, whereby the inner, interior and outer regions are not discrete layers and are not separated by distinct interfaces.

Claim 3 (Original): A thermal barrier coating according to claim 1, wherein adjacent pairs of the columns are substantially equally spaced from each other along the inner, interior and outer regions thereof.

Claim 4 (Original): A thermal barrier coating according to claim 1,

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wherein the surface of the substrate is defined by a metallic bond coat that promotes adhesion of the thermal barrier coating to the substrate.

Claim 5 (Original): A thermal barrier coating according to claim 1, wherein the ceramic material within the inner, interior and outer regions has the same composition.

Claim 6 (Original): A thermal barrier coating according to claim 5, wherein the ceramic material consists essentially of zirconia and yttria.

Claim 7 (Original): A thermal barrier coating according to claim 1, wherein the ceramic material of at least one of the inner, interior and outer regions is chosen from the group consisting of ceramic materials having a lower thermal conductivity than zirconia stabilized by seven weight percent yttria, ceramic materials having greater CMAS-resistance than zirconia stabilized by seven weight percent yttria, and ceramic materials having greater erosion resistance than zirconia stabilized by seven weight percent yttria.

Claim 8 (Original): A thermal barrier coating according to claim 1,

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wherein the substrate is a gas turbine engine component.

Claim 9 (Original): A thermal barrier coating according to claim 8,
wherein the component is a turbine blade.

Claim 10 (Original): A thermal barrier coating according to claim 8,
wherein the component is a vane.

Claim 11 (Original): A thermal barrier coating according to claim 10,
wherein the surface of the substrate is a leading edge of the component.

Claim 12 (Currently amended): A coating system on a surface of a
gas turbine engine component, the coating system comprising a bond coat on
the surface and a thermal barrier coating on the bond coat, the thermal barrier
coating being formed of a ceramic material and having a columnar
microstructure comprising columns extending from the surface of the
component, the columns having inner regions contacting the surface of the
component, outer regions at an outermost surface of the thermal barrier
coating, and interior regions therebetween, the ceramic material within the

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inner, interior and outer regions substantially having the same composition, the inner regions of the columns being substantially normal to the surface of the substrate and the interior regions of the columns comprising multiple first portions ~~substantially normal to the surface of the substrate~~ and multiple second portions between the first portions so that each adjacent pair of the first portions is separated by one of the second portions, at least one of the first and second portions being linear, at least one adjacent pair of the first and second portions being separated and adjoined by a curved portion ~~separated by the first portions and not normal to the surface of the substrate~~ so that the columns of the columnar microstructure are continuous but modulated within the interior regions. ~~regions to reduce tensile stresses within the columns resulting from particle impact such that cracking of the columns from particle impact is more likely to occur within the outer regions of the columns as compared to the inner regions of the columns.~~

Claim 13 (Original): A coating system according to claim 12, wherein the thermal barrier coating is characterized by the substantial absence of columns that are discontinuous between the surface of the component and the outermost surface of the thermal barrier coating, whereby

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the inner, interior and outer regions are not discrete layers and are not separated by distinct interfaces.

Claim 14 (Original): A coating system according to claim 12, wherein adjacent pairs of the columns are substantially equally spaced from each other along the inner, interior and outer regions thereof.

Claim 15 (Original): A coating system according to claim 12, wherein the ceramic material consists essentially of zirconia and yttria.

Claim 16 (Original): A coating system according to claim 12, wherein the ceramic material of at least one of the inner, interior and outer regions is chosen from the group consisting of ceramic materials having a lower thermal conductivity than zirconia stabilized by seven weight percent yttria, ceramic materials having greater CMAS-resistance than zirconia stabilized by seven weight percent yttria, and ceramic materials having greater erosion resistance than zirconia stabilized by seven weight percent yttria.

Claim 17 (Original): A coating system according to claim 12,

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wherein the component is a turbine blade.

Claim 18 (Original): A coating system according to claim 12,
wherein the component is a vane.

Claim 19 (Original): A coating system according to claim 12,
wherein the surface of the component is a leading edge of the component.

Claims 20-43 (Canceled)

Claim 44 (New): A thermal barrier coating according to claim 1,
wherein at least one of the first and second portions within the interior region
of each column is linear and aligned with its respective inner region.

Claim 45 (New): A thermal barrier coating according to claim 1,
wherein the first and second portions of at least one adjacent pair of the first
and second portions within the interior region of each column are linear and
aligned with their respective inner region.

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Claim 46 (New): A thermal barrier coating according to claim 1, wherein at least one of the first and second portions within the interior region of each column is linear and nonaligned with its respective inner region.

Claim 47 (New): A thermal barrier coating according to claim 1, wherein the first portions of the interior regions are linear and aligned with their respective inner regions and the second portions of the interior regions are linear and nonaligned with their respective inner regions.

Claim 48 (New): A thermal barrier coating according to claim 1, wherein the first and second portions of the interior regions are linear and nonaligned with their respective inner regions and oriented in opposite directions from a normal to the surface of the substrate.

Claim 49 (New): A thermal barrier coating according to claim 1, wherein the second portions of the interior regions are linear and nonaligned with their respective inner regions and alternately oriented in opposite directions from a normal to the surface of the substrate.

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Claim 50 (New): A coating system according to claim 12, wherein at least one of the first and second portions within the interior region of each column is linear and aligned with its respective inner region.

Claim 51 (New): A coating system according to claim 12, wherein the first and second portions of at least one adjacent pair of the first and second portions within the interior region of each column are linear and aligned with their respective inner region.

Claim 52 (New): A coating system according to claim 12, wherein at least one of the first and second portions within the interior region of each column is linear and nonaligned with its respective inner region.

Claim 53 (New): A coating system according to claim 12, wherein the first portions of the interior regions are linear and aligned with their respective inner regions and the second portions of the interior regions are linear and nonaligned with their respective inner regions.

Claim 54 (New): A coating system according to claim 12, wherein

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the first and second portions of the interior regions are linear and nonaligned with their respective inner regions and oriented in opposite directions from a normal to the surface of the substrate.

Claim 55 (New): A coating system according to claim 12, wherein the second portions of the interior regions are linear and nonaligned with their respective inner regions and alternately oriented in opposite directions from a normal to the surface of the substrate.